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PAINTING INTERIOR WALLS AND TRIM

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INTRODUCTION

The paint industry sells annually in this country upwards of 700 million dollars worth of paint and varnish products. A large percentage of these coatings is used on the interior of structures. Their main use is to obtain pleasing decorative effects, but also they are widely applied to improve sanitary conditions, to provide better lighting, to promote safety in machine operation by the proper use of color on equipment and walls, and to serve a variety of other special needs.

This letter circular is designed to answer a large volume of requests received by this Bureau for information on painting interior surfaces, particularly wood and plaster. There is presented a general description of interior paints and a discussion of painting problems. Painting procedures of general applicability are suggested. Necessarily many of the recommendations are quite general, and they are not intended to supplant manufacturers' directions for the use of particular products. Consideration is given only to types of paint that are regularly obtainable and to the conventional surfaces to which they are applied. No attempt has been made to present solutions to unusual problems which may be encountered, and the relation of plaster to paint failure also is dealt with only superficially. Understandably, no information is given on brands of paint.

#### TYPES OF INTERIOR PAINTS

Wall primers.— Wall primers, or primer-sealers as they are sometimes called, are intended to be applied directly to bare plaster, wallboard, and similar porous surfaces. They may accomplish various things, depending on the aims and ability of the formulator. Their main purpose, however, is to provide a uniform, sealed surface for subsequent coats of paint. A typical product is made from a varnish or bodied oil vehicle in which a moderate amount of hiding pigments of medium or high strength together with inert pigments are ground in order to give a product of at least moderately good hiding power and a fair degree of gloss in the dried film. Such a formulation is intended to penetrate only slightly into porous surfaces and to be easily applied with a wide wall brush. Federal Specification TT-P-56 describes a primer-sealer suitable for use on plaster and wallboard.

One-coat flats.— One-coat flat paints are organic-solvent-thinned paints intended to accomplish priming, sealing, and finish coating in one operation. They are often sold in thin paste form so that additional inexpensive thinner may be added and mixed before application to increase the volume by one-fourth or more. To keep as much of the film on the surface as possible, paints of this type usually utilize the non-penetrating principle to a high degree. Federal Specification TT-P-47 covers a one-coat flat type of finish. . . . .

Flat, semigloss, and gloss paints.— Flat, semigloss, and gloss interior paints and enamels vary in composition as necessary to produce the desired degree of gloss, hiding power, and other properties. Best hiding power for paints of a given lightness is normally associated with paints of lowest gloss, although some modern high-gloss enamels utilizing full-strength, high-hiding pigments have this property to a high degree. Federal Specification TT-P-51 covers flat interior oil paints, TT-E-508 semi-gloss enamels, and TT-E-506 full gloss enamels.

Flat and semigloss interior paints may also be prepared from paste white lead and a suitable vehicle. Directions for application subsequently given apply both to these paints and to the ready-mixed type.

Water paints.- Water-thinned interior paints are exemplified by calcimine, casein (or other protein) paints, resin emulsion, and the new gloss water paints. Calcimine is supplied in powder form. It consists essentially of whiting and clay intimately mixed with an animal glue binder, together with a preservative. Calcimine can be washed off easily from the wall before redecorating. There is a type suitable for mixing with hot water and one for use with cold water. Federal Specification TT-C-96 covers both types. Paints employing casein or soya protein are sometimes referred to as "washable" calcimines, although their formulation is more complex than calcimine, with the proteins used as the binder instead of glue. Both powder and paste forms are available and both are designed for mixing with water at moderate temperature. Federal Specification TT-P-23 covers the powder and paste forms. The desire for something better than the water paints just described led to the resin emulsion paints, which are marketed in paste form and are usually designed for thinning with water in the proportion of one-half gallon of water to one gallon of paste. These paints usually have an oleoresinous binder dispersed in water (emulsified drying oils or varnishes) and are stabilized with protein so that they have some of the characteristics of both the water-thinned and organic-solvent-thinned types. They may be decidedly complex in nature and difficult to formulate. When properly made and applied, resin emulsion paints adhere tenaciously to plaster and provide a good decorative medium. They need not be removed before redecorating, provided the film is in sound condition. Federal Specification TT-P-88 covers resin emulsion paints. Water-thinned paints are relatively new at this writing and consequently have not been as widely used nor as thoroughly investigated as the flat finish type, although the fact that they can be produced commercially is acknowledged in the trade to be a technical achievement of merit. They are known to be characterized by unusually good brushing properties, however, for a gloss product. There is no Federal Specification at present for this material.

#### PAINTING WALLS AND CEILINGS

Plaster.- Plaster is one of the most difficult surfaces to paint successfully. The reasons for this are not difficult to understand. Unlike steel, plaster is porous (and of varying porosity). Unlike wood, which is porous also, plaster contains materials of an alkaline nature which tend to have a destructive action toward oil paints. Added to this is the fact that new plaster contains large amounts of water; moreover the plaster is usually applied to porous materials (brick, for example) which are also wet. It is estimated that the water in the brickwork and plaster of an average room after just being constructed is about one ton. Even under ordinary good drying conditions, many

months are required for this water to evaporate. If the surface is sealed with paint, drying is prolonged still further. Thus if it were possible to avoid painting until the structure became dry, many painting difficulties would disappear.

Paint failures over plaster may take various forms, but one of the most objectionable and certainly one of the most common forms is that of flaking, in which small pieces of film become detached and fall from the surface. Other forms of failure include scaling or peeling of relatively large pieces of film, softening and darkening of the paint, the development of glossy or dull spots, change of color of some paints, etc.

The causes of some of these types of failure are known, others are suspected, and some are not known. The plaster surface itself may be inferior because of the use of poor materials, improper proportioning and mixing of ingredients, or of imperfect technique of the plasterer. While it is obviously impossible to determine the existence of some of these potential sources of paint failure, others can be recognized and avoided.

As has been previously stated, newly laid plaster contains a large volume of water which, if not allowed to dry out before painting, may exert mechanical action to loosen a paint film. In addition to the loss of adhesion by mechanical action, the presence of water, hydrated lime, and alkali salts (from the water, brick, sand, etc.) cause a chemical action ("saponification"); the film becomes softened and sticky, and brownish drops (saponified oil) may appear on the surface of the paint. Besides attacking the oil, certain pigments such as chrome green and Prussian blue become bleached or discolored by the alkaline water. Likewise, soluble salts present in most building materials (in the sand and cement of the mortar, in the water, in the plaster undercoats, in the finish plaster, etc.) are sometimes carried to the surface and appear as a white powder or "efflorescence". When this forms underneath the paint, general peeling and flaking occur. Saponification and efflorescence are apt to occur together. A slow water leak extending over a considerable period of time so that the water saturates the plaster is almost certain to result in saponification followed by efflorescence..

While moisture and the presence of alkali have been blamed for many paint failures for which they probably were not responsible, it is nevertheless wise to avoid this condition whenever possible. This applies to moisture which may reach the plaster subsequent to drying as well as to that originally present in the wet coat.

Other conditions that can be detected and avoided are soft spots in the plaster, badly cracked areas, powdery surfaces, and varicolored areas. Some of these conditions may not be certain to cause paint failure while others almost certainly will. A first-class re-plastering of the affected areas where the more serious defects exist is indicated if it is desired to reduce to a minimum the possibility of paint failure.

New dry plaster in good condition, which is to be finished with a paint other than water paint, should be given a coat of primer-sealer, and this should be allowed to dry thoroughly and then inspected for uniformity of appearance. Particular note should be made of variations in gloss and, in the case of tinted primers, of color differences. If there is non-uniformity, it may be advisable to recoat the entire surface with the priming paint. However, if only a few "suction spots" are apparent, a second coat over these areas may be sufficient. It is very important that the dry, unpainted plaster be made uniform as to color, gloss, and appearance by means of the primer-sealer before applying finishing coats of paint. Uniform surface conditions are particularly important if the finish coat is to be a semigloss or gloss product. One coat of flat finish paint is often sufficient over a properly primed and sealed surface, although a second coat may be applied if desired. Semigloss and gloss paints and enamels usually require special undercoaters as an intermediate coat, but in some instances they may be applied directly to the primed surface. It is important to follow the manufacturer's directions in using these materials if a surface of uniform appearance with respect to gloss and color is to be obtained.

Before applying water paints of the calcinine type to new plastered walls they should be sized, using either a glue-water size or, if the plaster is dry, a thin varnish or primer-sealer. Cold water paints of the protein type (casein or similar binder) may be applied either directly to a plastered surface, or the surface may first be given a coat of primer-sealer to equalize uneven suction effects. The same is true of resin emulsion paints, with the recommendations of the manufacturer of the product being given preference in any case of doubt. Since resin emulsion paints usually contain some oil in the binder, they should ordinarily be applied only to plaster which has dried thoroughly.

Composition wallboard.— Composition wallboard usually presents no particular painting difficulties if the ordinary precautions are observed, such as making certain that the surface is dry and free from grease or oil. In general, the painting procedure is the same as for plaster; a priming and sealing coat is required, followed by whatever finish coats are desired. If it is desired to restrict the painting system to one coat, the previously described one-coat flat or resin emulsion type paints may be used. These paints combine a priming and sealing action with their other characteristics.

Fabrics.- Fabrics such as canvas or muslin, which are very absorbent, should be given a coating of glue size and allowed to dry before application of an oil paint. Resin emulsion paints could probably be applied directly to the unsized fabric if the paint for the first coat were thinned sufficiently with water. Fabric painting, however, may be a special problem, and it is suggested that in any case of doubt advice on the particular problem at hand be obtained before proceeding.

Wallpaper.- Paint may be applied over wallpaper if the latter is well bonded to the wall, does not contain dyes which will bleed into the paint, and there are not too many thicknesses of paper on the wall - it is preferable to have not more than one. Much of the popularity of resin emulsion paints is due to the fact that many of them have been developed for application over paper. Directions for application are usually printed on the label of the container. Paints other than those of the water-thinned type may also be used for this purpose by following the directions given for painting plaster. It may be pointed out, however, that wallpaper under such a paint system is very difficult to remove without injury to the plaster.

Masonry.- Interior masonry walls and ceilings may, in general, be painted in much the same manner as plaster surfaces. Here again, it is necessary to allow adequate time for drying, and in addition some attention must be given to the preparation of the surface. When decorating a material containing Portland cement (concrete, for example), it is essential to take special precautions against the attack of alkali. Alkali-resistant primers should be used (preferably in two coats) when oil paints are to follow, and lime-resistant pigments should be used. The details of a recommended procedure for the latter are given in National Bureau of Standards Letter Circular LC747, Painting Exterior Walls of Porous Masonry.

#### PAINTING INTERIOR TRIM

Wood.- New interior wood trim should be smoothed with sandpaper and dusted before painting. Proprietary semigloss enamels thinned with one pint of turpentine per gallon of paint or a similar material prepared from paste white lead may be used as a first coat. The primer-sealer previously described for use on walls may also be used for this purpose. One or two coats of semigloss enamel should then be applied over the thoroughly dry prime coat, or if a full gloss finish is desired the last coat should be of that material.

Metal.- New interior metal trim should be cleaned to remove all rust, dirt, and grease and then given a coat of red lead or other rust-inhibiting paint. After ample time has been allowed for drying, particularly if a linseed oil-red lead primer is used, the finish coats should be applied in the same manner as has been indicated for wood trim.

## SPECIAL DECORATIVE EFFECTS

In addition to the plain wall finishes that have been described, there are a number of other decorative effects that can be achieved with paint and a few accessories such as a stippling brush, a sponge, or a crumpled roll of paper. The wall surface is, in each case, primed and sealed before any of the special coatings are applied.

Texture.- Textured effects can be obtained by the use of plastic paint made for this purpose in either the oil-base or water-base type. These are simply heavy-bodied materials which yield a film of sufficient thickness on the wall so that when troweled in a special manner or worked with the flat side of a paint brush or textured in various other ways, a raised irregular design is obtained.

Stipple.- A stippled effect is obtained in much the same manner by using a long bristled brush designed for the purpose which is tapped against the applied paint film before it has dried. The consistency of paint to be stippled is thicker than that of ordinary wall paint but slightly thinner than plastic paint. The result of a properly done stippling job is a pleasing, uniform appearance free from brush marks and, to an extent, wall surface imperfections.

Mottled two-tone.- Two-tone effects may be obtained in various ways. One of the simplest is to apply over a dried under coat of the desired color a second coat of different color and while the latter is still wet roll a crumpled wad of newspaper about one foot long firmly over the surface. It is best to begin at the ceiling and work down, using fresh newspaper for each strip and overlapping slightly. A two-color appearance of irregular design results from the wet paint being picked up by the rolled newspaper. A somewhat similar effect may be obtained by applying the topcoat of paint with the flat side of a sponge. The technique consists of flowing a small amount of the colored paint on a flat surface and then picking up some of the paint with the water-dampened sponge, which is then patted lightly against the wall. A colored pattern is thus applied which should be varied by changing the position of the sponge in the hand.

Glaze, Tiffany blend.- Glazed and blended effects are obtained by the use of flatting oil mixed with the desired colors in oil. An antique glaze is produced by applying the flatting oil colored as desired over the dry background color. This is then wiped lightly with a ball of cheesecloth. The glaze remaining in the depressions gives an antique appearance. The popular Tiffany blend is obtained by coating the light-colored dry under-coat with flatting oil over an area of about 25 square feet at a time and then spotting the wet area with colors in oil thinned with flatting oil. A piece of cheesecloth is then used to blend the colors, using a circular motion. The entire surface is then patted lightly with cheesecloth to complete the blending.

## PUBLICATIONS

The following publications relate somewhat to the subject under discussion and information is given as to how they may be obtained:

### Letter Circulars;

- LC445, Painting of steam and hot water radiators.
- LC489, Inside wall paint for chemical laboratories.
- LC747, Painting exterior walls of porous masonry.
- LC748, Refinishing wood furniture.
- LC758, Finishes for concrete floors.
- LC810, The painting of exterior wood surfaces.
- LC813, Dampness in basements and ground floors.
- LC831, The painting of exterior metal surfaces.

(Letter Circulars may be obtained free from the National Bureau of Standards).

### Federal Specifications;

- TT-E-506a, Enamel; Interior, Gloss, Light-Tints and White
- TT-E-508, Enamel; Interior, Semigloss, Tints and White
- TT-E-491, Enamel; Gloss, Synthetic (for Metal and Wood Hospital Furniture)
- TT-P-23a, Paint; Cold-Water, Interior, Light-Tints and White
- TT-P-47, Paint; Oil, Interior, One-Coat-Flat
- TT-P-51a, Paint; Oil, Interior, Eggshell-Flat Finish
- TT-P-56a, Paint; Primer-Sealer (For) Plaster and Wallboard

(These Federal specifications are priced at .5 cents each and may be obtained from the Superintendent of Documents, Washington 25, D. C.)

Paint Manual With Particular Reference to Federal Specifications, Report BMS105, price \$1.00, from the Superintendent of Documents. This booklet contains much practical information on paint and painting.